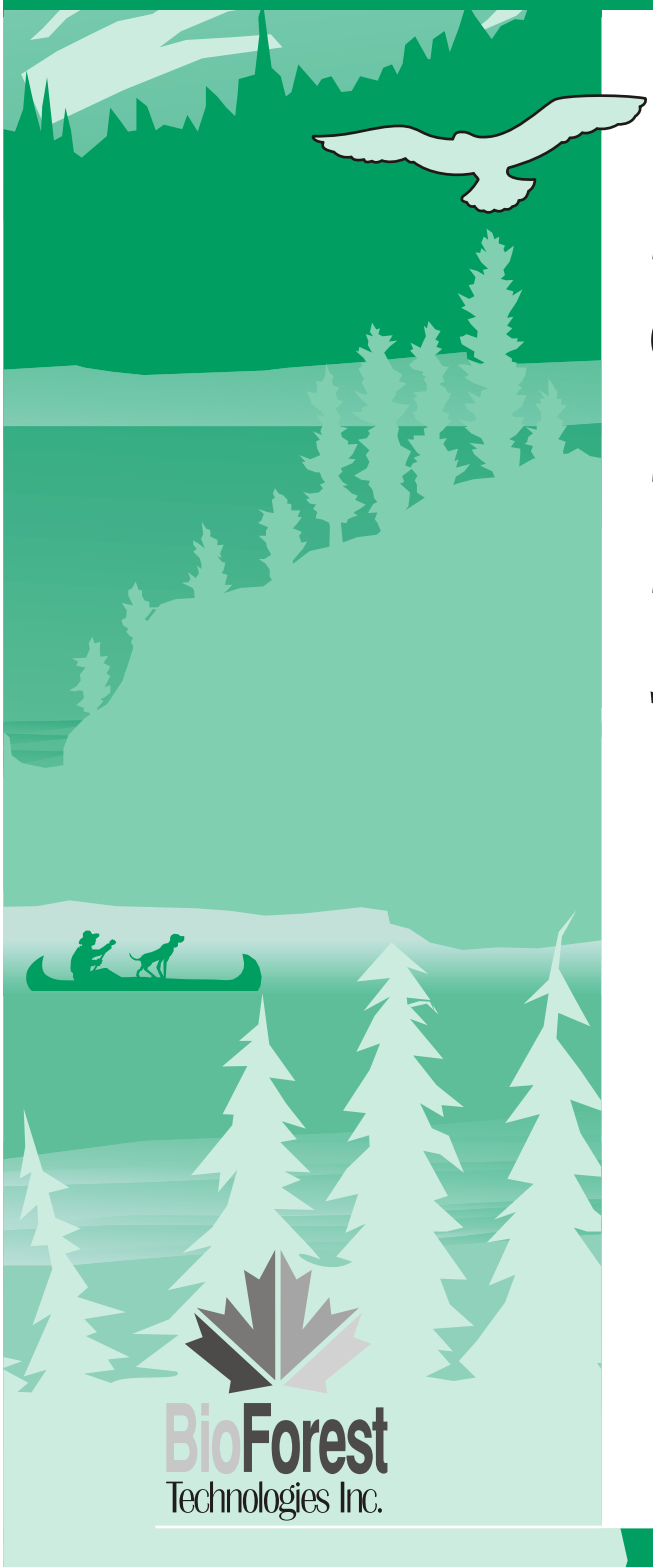
Lake Superior State Forest Sustainable Forest Management Pilot Project

REPORT 7



Establishing Criteria and Indicators for the Lake Superior State Forest

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1. Introduction

In order to make sound forest management decisions, it is necessary to identify what people value about the forest. These broad values or characteristics are called criteria. Several groups have undertaken the task of identifying criteria. The Canadian Standards Association (CSA), for example, outlines six national-level criteria to guide sustainable forest management in Canada (Canadian Standards Association 1996):

1. Conservation of biological diversity
2. Maintenance and enhancement of forest ecosystem condition and productivity
3. Conservation of soil and water resources
4. Forest ecosystem contributions to global ecological cycles
5. Multiple benefits to society
6. Accepting society's responsibility for sustainable development

The Great Lakes Forest Alliance (GLFA) developed five regional-level criteria for the Upper Great Lakes Region (Great Lakes Forest Alliance 1998):

1. Maintenance of biological resources
2. Maintenance of soil, water, and air quality
3. Provision of multiple economic benefits
4. Maintenance of community and cultural values
5. Society's framework for SFM

These criteria reflect broad national and regional values. However, for effective management on a specified area of forest, referred to as a "defined forest area" (DFA) by CSA, it is essential that local criteria be developed that capture issues associated with the DFA.

Each criterion identified for a DFA will have one or more indicators assigned to it. Indicators measure how well the local criteria are being maintained and enhanced. Local criteria and indicators help forest planners to assess sustainability and report the results to the public. The success of a management plan can be assessed by evaluating the measurable indicators identified for each local criterion.

As part of the Lake Superior State Forest Sustainable Forest Management Pilot Project, a process was designed for identifying local criteria and indicators for the Lake Superior State Forest (LSSF). Section 2 of this report

outlines the general process that was designed. Section 3 describes how this general process was used to develop a preliminary set of local criteria and indicators for the LSSF.

2. A Process for Establishing Criteria and Indicators

2.1 Public Participation

The final set of local criteria and indicators for a DFA will depend on the specific characteristics of the DFA, and its local priorities and circumstances. To capture these items, the final set of local criteria and indicators should be determined through a public participation process. Public participation allows people who are directly affected by and/or interested in the management practices in the DFA to identify the local criteria they want sustained and enhanced. The public can be engaged in this process through one or a series of workshops.

2.2 Establishing Local Criteria

To establish local criteria for a DFA, planners should provide stakeholders with the opportunity to identify the characteristics of the forest that they value. The long list of items that will likely result can be grouped into a manageable number of local criteria. The six national-level criteria of the CSA are meant to be broad in scope and, as such, can be a helpful starting point for identifying local criteria for the DFA. Another useful source is the set of regional-level criteria and indicators for the Upper Great Lakes Region that was developed by the GLFA.

2.3 Establishing Indicators

Indicators are used to track the status of the local criteria for a DFA. Therefore, at least one indicator is assigned to each local criterion, but an indicator may apply to more than one local criterion. To be useful, indicators should be:

- measurable,
- predictable,
- relevant,

- understandable,
- valid, and
- feasible.

It is important that indicators possess all these characteristics because, for example, while an indicator may be relevant and understandable, if it is not measurable it will not be useful.

When establishing indicators for a DFA, it is helpful to formulate a list of potential indicators for stakeholders to review. For example, CSA identifies indicators for each of its six national-level criteria, and GLFA identifies indicators for each of its five regional-level criteria. These lists can be useful starting points for identifying indicators for a DFA. Some of the CSA and GLFA indicators will not be well-suited to the DFA, and others may require modification to make them suitable. New indicators, specific to the DFA, should be included as well.

2.4 Setting Targets and Practices for Indicators

A target is the desired level to be achieved by an indicator. Targets need to be set for each indicator, and appropriate technical expertise should be drawn upon to do so. The process outlined in Figure 2-1 can be used to identify targets. The public should be given the opportunity to comment on the established targets.

Target setting will require optimizing targets among several competitive indicators. Techniques for doing this can include the use of computer assisted decision support systems and the opinions of involved members of the public and outside experts.

Practices are on-the-ground forest management activities designed to achieve the targets set for indicators. Appropriate technical expertise should be drawn upon when identifying practices.

2.5 Categorizing Indicators as Levers and Gauges

Once a list of indicators has been developed, it is useful to divide it into those indicators that can be managed directly and those that can only be monitored. Indicators that can be managed are called “levers” and those that are monitored are called “gauges”.

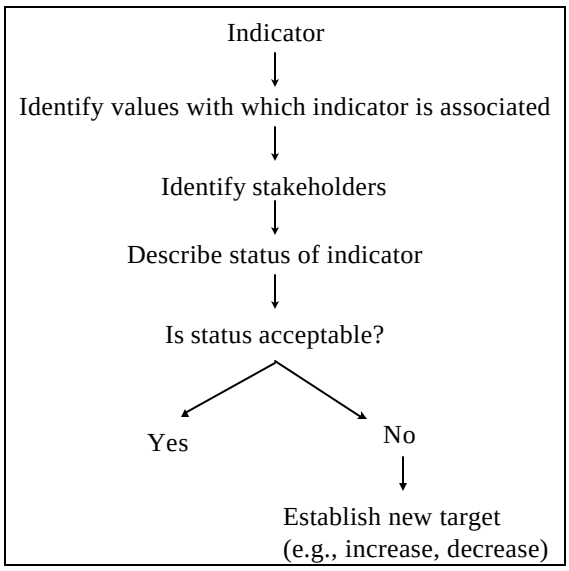

Figure 1. Suggested process for developing targets for indicators.

2.6 Assigning Responsibility for Indicators

For a sustainable forest management system to be effective, each indicator should be assigned to an individual, group or agency that will assume responsibility for monitoring that indicator relative to its target.

2.7 Monitoring and Reporting on Indicators

Monitoring and reporting on indicators is used to assess sustainability and to communicate results to the public. Monitoring and reporting on indicators also allows forest managers to assess the success of a management plan.

Each indicator should be monitored and a separate report should be prepared for each indicator. It is important to post and/or circulate the reports.

Each report should provide a thorough analysis of the results gathered from monitoring the indicator. For example, the report should include an analysis of the indicator on a landscape scale.

In addition to reporting on the results gathered from monitoring the indicator, each report should include an assessment of how well the indicator is performing. It is important that the indicators remain useful for measuring the status of the local criteria they were designated to measure.

2.8 Reviewing Local Criteria and Indicators

The local criteria and indicators established for a DFA should be reviewed regularly and modified on the basis of changes in public values, technology, and our understanding of the forest ecosystem. Indicators that are no longer performing well will have to be replaced with more appropriate indicators. Changes to local criteria and indicators will require input from the public.

3. Establishing Criteria and Indicators for the LSSF

This section describes how the process outlined in Section 2 was used to develop a list of criteria and indicators for the LSSF.

3.1 Public Consultation

The local criteria and indicators that have been identified for the LSSF were developed with stakeholders and MDNR staff. To achieve this, two workshops were held with MDNR staff and LSSF stakeholders in Newberry, Michigan on June 25 and 26, 1998 (Workshop I) and on October 21 and 22, 1998 (Workshop II). The results from Workshops I and II can be found in the LSSF SFM Project reports entitled *Workshop I Summary: Values and Indicators of the Lake Superior State Forest* (Hayes *et al*. 1999a) and *Workshop II Summary: Establishing Targets, Practices and Responsibilities for the Indicators of the Lake Superior State Forest* (Hayes *et al*. 1999b).

3.2 Establishing LSSF Criteria

To establish local criteria for the LSSF, participants in Workshop I were asked to identify what they value in the LSSF. Participants identified 268 characteristics of the LSSF that they value. After grouping similar values,

they identified the following 12 local criteria as those that are important to sustain and enhance:

1. Ownership Patterns
2. Institutional Processes
3. Recreation
4. Multiple Use
5. Spiritual
6. Social/Cultural
7. Economic Health
8. Biodiversity
9. Healthy Forests
10. Biological Cycles
11. Quality of Water and Soil Resources
12. Unique Features

For certification purposes, CSA would require that local criteria address the concepts associated with its six national-level criteria. A comparison of the local criteria for the LSSF, the CSA criteria and the GLFA criteria shows that LSSF criteria have captured the concepts associated with both the CSA and the GLFA criteria. Two local criteria for the LSSF, Ownership Patterns and Unique Features, are different the CSA and GLFA criteria. The concepts captured in these two local criteria are quite specific to the LSSF, and therefore are not reflected in the broader national and regional criteria of the CSA and GLFA.

3.3 Establishing LSSF Indicators

Workshop participants identified indicators for each of the 12 local criteria. To help with this task, participants were given the CSA indicators to review and consider as potential indicators for the LSSF. At Workshop II, stakeholders had the opportunity to fine-tune the list of indicators. A summary of the LSSF indicators and the local criteria with which they are associated is presented in Table 1. Descriptions of the LSSF indicators are provided in Table 2.

After Workshop II, the LSSF project team reevaluated the LSSF indicators against the CSA indicators. A list of all 83 CSA indicators is provided in Appendix 1 for reference purposes. In general, conformance between the CSA and LSSF indicators was high. A head-to-head comparison of the LSSF and CSA indicators is provided in Appendix 2.

Table 1. Values and indicators as determined by LSSF stakeholders.

Indicator	Ownership Patterns	Institutional Processes	Recreation	Multiple Use	Spiritual	Social/ Cultural	Economic Health	Biodiversity	Healthy Forests	Biological Cycles	Quality of Water and Soil Resources	Unique Features
Road density	✓				✓							
Ownership type and land use	✓											
Stewardship	✓											
Changes in ownership	✓											
Existence of audit or assessment program		✓										
Integrated planning system		✓	✓									
Response to public requests		✓										
Public participation in review of initial plan and audit or assessment program		✓										
User days/activity			✓		✓							
Miles of trail systems by land-use designation			✓			✓						
Size and distribution of natural and 'special' areas and allowed use for those areas			✓		✓							✓
Area of forest by type, age class and quality			✓					✓	✓			
Number, type and quality of educational and recreational resources			✓									✓
Diversity of recreational opportunities			✓			✓						
Quality of recreational experience			✓									
Provision for sufficient number of other values				✓								
Number of educational and recreational resources and presence of information resources					✓							
Change in status of land ownership, use and distribution					✓							
Amount of trash in forest					✓							
Number of historic sites						✓						✓
Presence and implementation of a historic/archeological resource plan						✓						
Cultural forest products						✓						
Wood product summary							✓					

Table 1. Values and indicators as determined by LSSF stakeholders.

Indicator	Ownership Patterns	Institutional Processes	Recreation	Multiple Use	Spiritual	Social/ Cultural	Economic Health	Biodiversity	Healthy Forests	Biological Cycles	Quality of Water and Soil Resources	Unique Features
Ratio of harvest to growth by volume, species and products							✓					
Net quantity difference between growth and harvest							✓					
Correlation of LSSF with local economic development plans							✓					
Job/income/employment/retirement data							✓					
Area, percentage and representativeness of forest types in protected areas								✓	✓			
Forest regeneration by forest type and silvicultural prescription								✓				
Population levels, habitat and changes over time of selected species guilds								✓	✓			✓
Water quality									✓			
Presence of pest assessment									✓			
Forest growth									✓			
Exotic species									✓			
Cycles relative to historic patterns									✓			
Landscape health and integrity of natural cycles										✓		✓
Land ownership, use, quality and fragmentation											✓	
Landscape health and integrity of water and soil resources											✓	
Presence of land-cover assessment/ inventory											✓	
Quality of fisheries												✓
Miles of undeveloped shoreline												✓
Wetlands												✓
Number of known forest-dependent species classified as extirpated, threatened, endangered, rare, or vulnerable relative to total number of known forest-dependent species								✓	✓			

[cont'd]

Table 1. Values and indicators as determined by LSSF stakeholders.

Indicator	Ownership Patterns	Institutional Processes	Recreation	Multiple Use	Spiritual	Social/ Cultural	Economic Health	Biodiversity	Healthy Forests	Biological Cycles	Quality of Water and Soil Resources	Unique Features
Number of known forest-dependent species that occupy only a small portion of their former range								✓	✓			
Area and severity of fire damage									✓			
Mean annual increment by forest type and age class									✓			
Percentage of forest area having road construction and stream crossing guidelines in place		✓										
Tree biomass volumes									✓			
Existence of laws and regulations on forest land management		✓										
Management and development expenditures							✓		✓			
Contribution to gross domestic product (GDP) of the timber sector of the forest economy							✓					
Total expenditures by individuals on activities related to non-timber use			✓				✓					
Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights		✓										
Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural, or spiritual sites					✓	✓						✓
Percentage of area covered by multi-attribute resource inventories		✓										
Mutual learning mechanisms and processes		✓										

Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
Ownership Patterns	Road density	Type (primary, secondary, tertiary) and length (miles) of road and characteristics of the area within 1 mile of the roads.
	Ownership type and land use	Measures land ownership type (federal, state, corporate, individual, etc.), land use (productive, unproductive, recreational, etc.), land distribution and zoning practices.
	Stewardship	The level, quality, and quantity of stewardship on private land.
	Changes in ownership	Measures parcel size/parcel fragmentation.
Institutional Processes	Existence of audit or assessment program	Determines whether or not an audit or assessment procedure is in place.
	Integrated planning system	Determines whether or not a planning system is in place that takes into account values from the various parties interested in the forest.
	Response to public requests	Measures adherence to a policy for responding to public requests in a timely fashion.
	Public participation in review of initial plan and audit or assessment program	Determines whether or not the public has been given adequate opportunity to review the forest management planning process and the audit or assessment program.
	Percentage of forest area having road construction and stream crossing guidelines in place	Identifies how much of the forest has existing guidelines for road construction and stream crossings.
	Existence of laws and regulations on forest land management	Determines whether or not there are laws and regulations in place that address forest land management and direct forest managers in their daily operations.
	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights	Monitors the integration of relevant Aboriginal and treaty rights into the forest management planning process.
	Percentage of area covered by multi-attribute resource inventories	Measures the amount of forest where non-timber and timber resources have been inventoried.
	Mutual learning mechanisms and processes	The number of opportunities (e.g. conferences, workshops, etc.) for representatives from a broad range of interest groups to meet and discuss forest management issues.

[cont'd]

Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
Recreation	User days/activity	The number of days people spend on various activities in the forest (e.g., hunting, fishing, camping, learning, enjoying nature, etc.).
	Miles of trail systems by land-use designation	Measures the miles of trail systems and trail use (e.g., snowmobiling, cross-country skiing, hiking, etc.).
	Size and distribution of natural and 'special' areas and allowed use for those areas	Measures size (acres), number, distribution and interconnectedness of natural areas, corridors, etc., and how those areas are used.
	Integrated planning system	Determines whether or not a planning system is in place that takes into account values from the various parties interested in the forest.
	Area of forest by type, age class and quality	Information from the Operations Inventory manual and basic Forest Inventory and Analysis (FIA). Small, uncommon forest types should be included.
	Number, type and quality of educational and recreational resources	The number of viewing areas, interpretive centers, areas and trails for both education and recreation.
	Diversity of recreational opportunities	The availability of different ways for people to use the forest provides a measure of the various ways they can access the forest.
	Quality of recreational experience	Surveys users of the forest to determine the level of quality of recreational experiences.
	Total expenditure by individuals on activities related to non-timber use	Measures the amount of money spent on non-timber activities such as snowmobiling, hunting, camping, etc.
Multiple Use	Provision for sufficient number of other values	Measures whether a sufficient number of indicators is satisfied for each value.
Spiritual	Size and distribution of natural and 'special' areas and allowed use for those areas	Measures size (acres), number, distribution and interconnectedness of natural areas, corridors, etc., and how those areas are used.
	User days/activity	The number of days people spend on various activities in the forest (e.g., hunting, fishing, camping, learning, enjoying nature, etc.).
	Number of educational and recreational resources and presence of information resources	The number of viewing areas, interpretive centers, areas and trails for both education and recreation. Monitors the presence of signage, greetings, pamphlets, etc., that enhance the public's enjoyment of the forest.
	Change in status of land ownership, use and distribution	Tracks change in ownership type (federal, state, corporate, individual, etc.), land use (productive, unproductive, recreational, etc.) and land distribution.
	Road density	Type (primary, secondary, tertiary) and length (miles) of roads and characteristics of the area within 1 mile of the roads.

[cont'd]

Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
	Amount of trash in forest	A measure of how much trash is in the forest.
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	Monitors the integration of unique or significant Aboriginal sites into forest management plans.
Social/Cultural	Diversity of recreational opportunities	The availability of different ways for people to use the forest provides a measure of the various ways they can access the forest.
	Miles of trail systems by land-use designation	Measures the miles of trail systems and what the trails are used for (e.g., snowmobiling, cross-country skiing, hiking, etc.).
	Number of historic sites	Measures the number of historic sites that have been identified and conserved.
	Presence and implementation of a historic/archeological resource plan	The degree to which historic and archeological sites are addressed in the planning system.
	Cultural forest products	Identifies and lists products (e.g., blueberries, mushrooms, black ash bark, cattails, etc.).
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	Monitors the integration of unique or significant Aboriginal sites into forest management plans.
Economic Health	Wood product summary	Annual statement of wood products
	Ratio of harvest to growth by volume, species and products	Compares data on volume of trees harvested by species and products with data on tree growth.
	Net quantity difference between growth and harvest	Compares trees grown to trees harvested.
	Correlation of LSSF with local economic development plans	Monitors how the current economic state of the LSSF compares with local economic development plans.
	Job/income/employment/retirement data	Examines readily available data on jobs, incomes, employment and retirement.

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Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
	Management and development expenditures	Monitors trends in spending for forest management. Data for resource access (road construction), wildlife management, recreation management, fire management, etc. can be used to determine management and development expenditures.
	Contribution to gross domestic product (GDP) of the timber sector of the forest economy	The combination of salaries, wages, profits, taxes and royalties for the sale of timber represents the contribution of the timber sector of the forest economy to the GDP.
	Total expenditure by individuals on activities related to non-timber use	Measures the amount of money spent on non-timber activities such as snowmobiling, hunting, camping, etc.
Biodiversity	Area of forest by type, age class and quality	Information from the Operations Inventory manual and basic Forest Inventory and Analysis (FIA). Small, uncommon forest types should be included.
	Area, percentage and representativeness of forest types in protected areas	Protected forest areas (including uncommon types) can be used as ecological benchmarks to compare undisturbed areas with areas managed for other purposes (including open areas).
	Forest regeneration by forest type and silvicultural prescription	Measures forest regeneration on the basis of silvicultural guidelines and forest type.
	Population levels, habitat and changes over time of selected species guilds	A group of species identified for each forest age class can be used to monitor species diversity and health of an ecosystem. Species can be chosen on the basis of various factors (e.g., breeding and feeding requirements, habitat requirements, etc.).
	Number of known forest-dependent species classified as extirpated, threatened, endangered, rare or vulnerable relative to total number of known forest-dependent species	Monitors the number of forest-dependent animal and plant species in each of the noted classifications.
	Number of known forest-dependent species that occupy only a small portion of their former range	Monitors the number of known forest-dependent species that have experienced a reduction in their range of at least 50% in comparison with their known historical range.
Healthy Forests	Population levels, habitat and changes over time of selected species guilds	A group of species identified for each forest age class can be used to monitor species diversity and health of an ecosystem. Species can be chosen on the basis of various factors (e.g., breeding and feeding requirements, habitat requirements, etc.).
	Water quality	Measures oxygen content, sedimentation, coliform count, etc., of water bodies and compares them with standard levels.

[cont'd]

Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
	Area of forest by type, age class and quality	Information from the Operations Inventory manual and basic Forest Inventory and Analysis (FIA). Small, uncommon forest types should be included.
	Area, percentage and representativeness of forest types in protected areas	Protected forest areas (including uncommon types) can be used as ecological benchmarks to compare undisturbed areas with areas managed for other purposes (including open areas).
	Presence of pest assessment	Measures the impact of pests (e.g., insects, diseases, etc.) on the forest.
	Forest growth	Measures the amount of tree growth in a given time.
	Exotic species	Inventories the number and type of exotic species in the forest.
	Cycles relative to historic patterns	Evaluates the current status of natural cycles on the basis of the historic patterns of those cycles.
	Number of known forest-dependent species classified as extirpated, threatened, endangered, rare or vulnerable relative to total number of known forest-dependent species	Monitors the number of forest-dependent animal and plant species in each of the noted classifications.
	Number of known forest-dependent species that occupy only a small portion of their former range	Monitors the number of known forest-dependent species that have experienced a reduction in their range of at least 50% in comparison with their known historical range.
	Area and severity of fire damage	Measures the extent of wildfires and the stress they cause the forest. Wildfires are dominant ecological and environmental disturbances.
	Mean annual increment by forest type and age class	Measures, by forest type and age class, the average net annual increase in yield (expressed in terms of volume per unit area) of living trees up to a given age.
	Tree biomass volumes	Measures the volume of standing biomass and monitors if it is increasing, decreasing or remaining constant.
	Management and development expenditures	Monitors trends in spending for forest management. Data for resource access (road construction), wildlife management, recreation management, fire management, etc. can be used to determine management and development expenditures.
Biological Cycles	Landscape health and integrity of natural cycles	Measures the health of the cover (e.g., amount of water and air pollution) and the integrity of natural cycles.

[cont'd]

Table 2. Local criteria and indicators for the LSSF as developed with input from LSSF stakeholders.

Local Criteria	Indicator	Description
Quality of Water and Soil Resources	Land ownership, use, quality and fragmentation	Measures land-ownership type (federal, state, corporate, individual, etc.), land use (productive, unproductive, recreational, etc.), land quality and land fragmentation.
	Landscape health and integrity of water and soil resources	Measures the health of the cover (e.g., amount of water and air pollution) and the integrity of water and soil resources.
	Presence of land-cover assessment/ inventory	Assesses and inventories geological features of the land.
Unique Features	Size and distribution of natural and 'special' areas and allowed use for those areas	Measures size (acres), number, distribution and interconnectedness of natural areas, corridors, etc., and how those areas are used.
	Number, type and quality of educational and recreational resources	The number of viewing areas, interpretive centers, areas and trails for both education and recreation.
	Number of historic sites	Measures the number of historic sites that have been identified and conserved.
	Population levels, habitat and changes over time of selected species guilds	A group of species identified for each forest age class can be used to monitor species diversity and health of an ecosystem. Species can be chosen on the basis of various factors (e.g., breeding and feeding requirements, habitat requirements, etc.).
	Landscape health and integrity of natural cycles	Measures the health of the cover (e.g., amount of water and air pollution) and the integrity of natural cycles.
	Quality of fisheries	Determines quality of fisheries as measured by stream classifications.
	Miles of undeveloped shoreline	Determines the miles of undeveloped shoreline and monitors changes.
	Wetlands	Inventories the number and type of wetlands and monitors changes.
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	Monitors the integration of unique or significant Aboriginal sites into forest management plans.

Of the 42 indicators that were developed at the workshops, only the following six LSSF indicators were viewed as being distinctly different from those developed by CSA:

- Existence of audit or assessment program
- Response to public requests
- Size and distribution of natural and 'special' areas and allowed use for those areas
- Quality of recreational experience
- Number of historic sites
- Land-cover assessment/inventory

A list of indicators common to the LSSF and CSA is found in Appendix 3. There were 40 CSA indicators for which there were no matching LSSF indicators. These CSA indicators are listed in Appendix 4. Most of the CSA indicators that did not have comparable LSSF indicators were related to the CSA criterion addressing Aboriginal involvement in forest management and the criterion requiring documentation of the forest ecosystem's contribution to global ecological cycles. To determine if any of the CSA indicators listed in Appendix 4 would be suitable for the LSSF, MDNR staff reviewed the indicators. Fourteen of the indicators were deemed useful for the LSSF. These 14 indicators are listed in Appendix 5, and have been added to the final list (Tables 1 and 2) of LSSF indicators developed during the two workshops.

3.4 Setting Targets and Practices for LSSF Indicators

Preliminary attempts were made to identify targets and practices for the LSSF indicators. Progress that was made on this task is described in the summary report for Workshop II (Hayes *et al*. 1999b). More work remains to be done, however.

3.5 Categorizing LSSF Indicators as Levers and Gauges

Following the workshops, the list of indicators developed by LSSF stakeholders was divided into "levers" (indicators that can be managed) and "gauges" (indicators that are monitored). Table 3 outlines which indicators were identified as levers and which as gauges.

Table 3. Local criteria and indicators for the LSSF, with each indicator identified as a lever or a gauge. Responsibility for managing or monitoring each indicator is assigned to the state or district level.

Local Criteria	Indicator	Type of Indicator		Responsibility (MDNR Division)
		Lever	Gauge	
Ownership Patterns	Road density	✓		District (FMD[1])
	Ownership type and land use		✓	State (Joint)
	Stewardship		✓	State (Joint)
	Changes in ownership		✓	State (Joint)
Institutional Processes	Existence of audit or assessment program	✓		District (FMD)
	Integrated planning system	✓		District (FMD)
	Response to public requests	✓		District (Joint)
	Public participation in review of initial plan and audit or assessment program	✓		District (Joint)
	Percentage of forest area having road construction and stream crossing guidelines in place	✓		District (Joint)
	Existence of laws and regulations on forest land management	✓		State (Joint)
	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights	✓		State (Joint)
	Percentage of area covered by multi-attribute resource inventories	✓		District (Joint)
	Mutual learning mechanisms and processes	✓		District (Joint)
Recreation	User days/activity		✓	District (Joint)
	Miles of trail systems by land-use designation	✓		State (Joint)
	Size and distribution of natural and 'special' areas and allowed use for those areas	✓		State (Joint)
	Integrated planning system	✓		State (Joint)
	Area of forest by type, age class and quality	✓		District (FMD)
	Number, type and quality of educational and recreational resources	✓		State (Joint)
	Diversity of recreational opportunities		✓	State (Joint)
	Quality of recreational experience		✓	State (Joint)

[1] Forest Management Division

[cont'd]

Table 3. Local criteria and indicators for the LSSF, with each indicator identified as a lever or a gauge. Responsibility for managing or monitoring each indicator is assigned to the state or district level.

Local Criteria	Indicator	Type of Indicator		Responsibility (MDNR Division)
		Lever	Gauge	
	Total expenditure by individuals on activities related to non-timber use		✓	State (Joint)
Multiple Use	Provision for sufficient number of other values	✓		State (Joint)
Spiritual	Size and distribution of natural and 'special' areas and allowed use for those areas	✓		State (Joint)
	User days/activity		✓	District (Joint)
	Number of educational and recreational resources and presence of information resources	✓		State (Joint)
	Change in status of land ownership, use and distribution		✓	State (Joint)
	Road density	✓		District (FMD)
	Amount of trash in forest		✓	District (FMD)
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	✓		State (Joint)
Social/ Cultural	Diversity of recreational opportunities		✓	State (Joint)
	Miles of trail systems by land-use designation	✓		State (Joint)
	Number of historic sites		✓	State (Parks)
	Presence and implementation of a historic/archeological resource plan	✓		State (Parks)
	Cultural forest products		✓	District (Joint)
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	✓		State (Parks)
Economic Health	Wood product summary		✓	State (FMD)
	Ratio of harvest to growth by volume, species and products	✓		District (FMD)
	Net quantity difference between growth and harvest	✓		District (FMD)
	Correlation of LSSF with local economic development plans		✓	State (FMD)
	Job/income/employment/retirement data		✓	State (FMD)
	Management and development expenditures	✓		State (FMD)

[cont'd]

Table 3. Local criteria and indicators for the LSSF, with each indicator identified as a lever or a gauge. Responsibility for managing or monitoring each indicator is assigned to the state or district level.

Local Criteria	Indicator	Type of Indicator		Responsibility (MDNR Division)
		Lever	Gauge	
	Contribution to gross domestic product (GDP) of the timber sector of the forest economy		✓	State (FMD)
	Total expenditure by individuals on activities related to non-timber use		✓	State (FMD)
Biodiversity	Area of forest by type, age class and quality	✓		District (FMD)
	Area, percentage and representativeness of forest types in protected areas	✓		District (FMD)
	Forest regeneration by forest type and silvicultural prescription	✓		District (FMD)
	Population levels, habitat and changes over time of selected species guilds		✓	State (WMD[2])
	Number of known forest-dependent species classified as extirpated, threatened, endangered, rare or vulnerable relative to total number of known forest-dependent species		✓	State (WMD)
	Number of known forest-dependent species that occupy only a small portion of their former range		✓	State (WMD)
Healthy Forests	Population levels, habitat and changes over time of selected species guilds		✓	State (WMD)
	Water quality		✓	State (DEQ)
	Area of forest by type, age class and quality	✓		District (FMD)
	Area, percentage and representativeness of forest types in protected areas	✓		District (FMD)
	Presence of pest assessment	✓		State (FMD)
	Forest growth		✓	State (FMD)
	Exotic species		✓	State (FMD)
	Cycles relative to historic patterns		✓	State (FMD)
	Number of known forest-dependent species classified as extirpated, threatened, endangered, rare or vulnerable relative to total number of known forest-dependent species		✓	State (WMD)

[2]Wildlife Management Division

[cont'd]

Table 3. Local criteria and indicators for the LSSF, with each indicator identified as a lever or a gauge. Responsibility for managing or monitoring each indicator is assigned to the state or district level.

Local Criteria	Indicator	Type of Indicator		Responsibility (MDNR Division)
		Lever	Gauge	
	Number of known forest-dependent species that occupy only a small portion of their former range		✓	State (WMD)
	Area and severity of fire damage		✓	State (FMD)
	Mean annual increment by forest type and age class		✓	District (FMD)
	Tree biomass volumes		✓	State (FMD)
	Management and development expenditures	✓		State (FMD)
Biological Cycles	Landscape health and integrity of natural cycles		✓	State (FMD)
Quality of Water and Soil Resources	Land ownership, use, quality and fragmentation		✓	State (FMD)
	Landscape health and integrity of water and soil resources		✓	State (FMD)
	Presence of land-cover assessment/inventory	✓		State (Joint)
Unique Features	Size and distribution of natural and 'special' areas and allowed use for those areas	✓		State (Joint)
	Number, type and quality of educational and recreational resources	✓		State (Joint)
	Number of historic sites		✓	State (Parks)
	Population levels, habitat and changes over time of selected species guilds		✓	State (WMD)
	Landscape health and integrity of natural cycles		✓	State (Joint)
	Quality of fisheries		✓	State (Fisheries)
	Miles of undeveloped shoreline	✓		State (FMD)
	Wetlands		✓	State (WMD)
	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites	✓		State (Parks)

Note: The divisional responsibility for indicators was assigned arbitrarily on the basis of the general assumption that the state has more responsibility for overall long-term planning and land-use designation, as well as for the collection of broad social and economic information.

3.6 Assigning Responsibility for LSSF Indicators

LSSF stakeholders were able to make some preliminary suggestions about who should be responsible for particular indicators. Following the workshops, the LSSF project team also outlined suggestions (Table 3) as to who should be responsible for particular indicators.

4. Conclusion

Identifying criteria and indicators for a DFA is a challenging task. It requires a great deal of time and patience on the part of the stakeholders undertaking the task. The stakeholders who participated in the criteria- and indicator-setting exercise as part of the LSSF SFM Pilot Project were extremely cooperative. Through their hard work and perseverance during the two workshops, a useful, preliminary list of local criteria and indicators has been created for the LSSF. Although there is still work to be done, and the list will inevitably change, the list provides a good starting point for future criteria- and indicator-setting endeavors for the LSSF.

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Hayes, A., C. Howard and T. Clark. 1999b. Workshop II Summary: Establishing Targets, Practices and Responsibilities for the Indicators of the Lake Superior State Forest. Report #9 from the Lake Superior State Forest Sustainable Forest Management Pilot Project. 56 p.

Appendix 1. Indicators developed by CSA.

CSA Indicator Number	CSA Indicator
A2.1.1.1	Percentage and extent, in area, of forest types relative to historical condition and to total forest area
A2.1.1.2	Percentage and extent of area by forest type and age class (see Clause A2.2.2.1)
A2.1.1.3	Area, percentage, and representativeness of forest types in protected areas
A2.1.1.4	Level of fragmentation and connectedness of forest ecosystem components
A2.1.2.1	Number of known forest-dependent species classified as extinct, threatened, endangered, rare, or vulnerable relative to total number of known forest-dependent species
A2.1.2.2	Population levels and changes over time of selected species and species guilds
A2.1.2.3	Number of known forest-dependent species that occupy only a small portion of their former range
A2.1.3.1	Implementation of an *in situ/ex situ* genetic conservation strategy for commercial and endangered forest vegetation species
A2.2.1.1	Area and severity of insect attack
A2.2.1.2	Area and severity of disease infestation
A2.2.1.3	Area and severity of fire damage
A2.2.1.4	Rates of pollutant deposition
A2.2.1.5	Ozone concentrations in forested regions
A2.2.1.6	Crown transparency in percentage by class
A2.2.1.7	Area and severity of occurrence of exotic species detrimental to forest condition
A2.2.1.8	Climate change as measured by temperature sums
A2.2.2.1	Percentage and extent of area by forest type and age class (see Clause A2.1.1.2)
A2.2.2.2	Percentage of area successfully naturally regenerated and artificially regenerated
A2.2.3.1	Mean annual increment by forest type and age class
A2.2.3.2	Frequency of occurrence within selected indicator species (vegetation, birds, mammals, fish)
A2.3.1.1	Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss of organic matter, etc.
A2.3.1.2	Area of forest converted to non-forest land use, e.g., urbanization (see Clause A2.4.2.1)
A2.3.1.3	Water quality as measured by water chemistry, turbidity, etc.
A2.3.1.4	Trends and timing of events in stream flows from forest catchments
A2.3.1.5	Changes in distribution and abundance of aquatic fauna
A2.3.2.1	Percentage of forest managed primarily for soil and water protection
A2.3.2.2	Percentage of forest area having road construction and stream crossing guidelines in place

[cont'd]

Appendix 1. Indicators developed by CSA.

CSA Indicator Number	CSA Indicator
A2.3.2.3	Area, percentage, and representativeness of forest types in protected areas (see Clause A2.1.1.3)
A2.4.1.1	Tree biomass volumes
A2.4.1.2	Vegetation (non-tree) biomass estimates
A2.4.1.3	Percentage of canopy cover
A2.4.1.4	Percentage of biomass volume by general forest type
A2.4.1.5	Soil carbon pools
A2.4.1.6	Soil carbon pool decay rates
A2.4.1.7	Area of forest depletion
A2.4.1.8	Forest wood product life cycles
A2.4.1.9	Forest sector CO_2 emissions
A2.4.2.1	Area of forest permanently converted to non-forest land use (e.g., urbanization) (see Clause A2.3.1.2)
A2.4.2.2	Semi-permanent or temporary loss or gain of forest ecosystems (e.g., grasslands, agriculture)
A2.4.3.1	Fossil fuel emissions
A2.4.3.2	Fossil carbon products emissions
A2.4.3.3	Percentage of forest sector energy usage from renewable sources relative to total sector energy requirement
A2.4.4.1	Recycling rate of forest wood products manufactured and used in Canada
A2.4.4.2	Participation in the climate change conventions
A2.4.4.3	Economic incentives for bioenergy use
A2.4.4.4	Existence of forest inventories
A2.4.4.5	Existence of laws and regulations on forest land management
A2.4.5.1	Surface area of water within forested areas
A2.5.1.1	Annual removal of forest products relative to the volume of removals determined to be sustainable
A2.5.1.2	Distribution of, and changes in, the land base available for timber production
A2.5.1.3	Animal population trends for selected species of economic importance
A2.5.1.4	Management and development expenditures
A2.5.1.5	Availability of habitat for selected wildlife species of economic importance
A2.5.2.1	Net profitability
A2.5.2.2	Trends in global market share
A.2.5.2.3	Trends in research and development expenditures in forest products and processing technologies

[cont'd]

Appendix 1. Indicators developed by CSA.

CSA Indicator Number	CSA Indicator
A2.5.3.1	Contribution to gross domestic product (GDP) of timber and non-timber sectors of the forest economy
A2.5.3.2	Total employment in all forest-related sectors
A2.5.3.3	Utilization of forests for non-market goods and services, including forest land use for subsistence purposes
A2.5.3.4	Economic value of non-market goods and services
A2.5.4.1	Availability and use of recreational opportunities
A2.5.4.2	Total expenditures by individuals on activities related to non-timber use
A2.5.4.3	Membership and expenditures in forest recreation-oriented organizations and clubs
A2.5.4.4	Area and percentage of protected forest by degree of protection
A2.6.1.1	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights
A2.6.2.1	Extent of Aboriginal participation in forest-based economic opportunities
A2.6.2.2	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural, or spiritual sites
A2.6.2.3	Number of Aboriginal communities with a significant forestry component in the economic base and the diversity of forest use at the community level
A2.6.2.4	Area of forest land available for subsistence purposes
A2.6.2.5	Area of Indian reserve forest lands under integrated management plans
A2.6.3.1	Number of communities with a significant forestry component in the economic base
A2.6.3.2	Index of the diversity of the local industrial base
A2.6.3.3	Diversity of forest use at the community level
A2.6.3.4	Number of communities with stewardship or co-management responsibilities
A2.6.4.1	Degree of public participation in the design of decision-making processes
A2.6.4.2	Degree of public participation in decision-making processes
A2.6.4.3	Degree of public participation in implementation of decisions and monitoring of progress toward sustainable forest management
A2.6.5.1	Percentage of area covered by multi-attribute resource inventories
A2.6.5.2	Investments in forest-based research and development and information
A2.6.5.3	Total effective expenditure on public forestry education
A2.6.5.4	Percentage of forest area under completed management plans/programs/guidelines which have included public participation
A2.6.5.5	Expenditure on international forestry
A2.6.5.6	Mutual learning mechanisms and processes

Appendix 2. Comparison of LSSF indicators and CSA indicators.

LSSF Indicator	Comparable CSA Indicator(s)
Road density	A2.1.1.4
Ownership type and land use	A2.3.1.2, A2.4.2.1, A2.4.2.2, A2.5.1.2
Stewardship	A2.6.3.4
Changes in ownership	A2.3.1.2, A2.4.2.1, A2.4.2.2
Existence of audit or assessment program	
Integrated planning system	A2.6.5.4
Response to public requests	
Public participation in review of initial plan and audit or assessment program	A2.6.4.1, A2.6.4.2, A2.6.4.3, A2.6.5.4
User days/activity	A2.5.4.1, A2.6.3.3
Miles of trail systems by land-use designation	A2.5.4.1, A2.6.3.3
Size and distribution of natural and 'special' areas and allowed use for those areas	
Area of forest by type, age class and quality	A2.1.1.2, A2.2.2.1, A2.4.4.4
Number, type and quality of educational and recreational resources	A2.5.4.1, A2.6.3.3
Diversity of recreational opportunities	A2.5.4.1, A2.6.3.3
Quality of recreational experience	
Provision for sufficient number of other values	A2.6.3.3
Number of educational and recreational resources and presence of information resources	A2.6.5.3
Change in status of land ownership, use and distribution	A2.3.1.2, A2.4.2.1, A2.4.2.2, A2.5.1.2
Amount of trash in forest	A2.2.1.4
Number of historic sites	
Presence and implementation of a historic/archeological resource plan	A2.1.1.1
Cultural forest products	A2.5.3.3, A2.5.3.4
Wood product summary	A2.4.1.8
Ratio of harvest to growth by volume, species and products	A2.4.1.7
Net quantity difference between growth and harvest	A2.5.1.1
Correlation of LSSF to local economic development plans	A2.6.3.1, A2.6.3.2
Job/income/employment/retirement data	A2.5.3.2, A26.3.1, A2.6.3.2
Area, percentage and representativeness of forest types in protected areas	A2.1.1.3, A2.3.2.3, A2.5.4.4
Forest regeneration by forest type and silvicultural prescription	A2.2.2.2
Population levels, habitat and changes over time of selected species guilds	A2.1.2.2, A2.2.3.2, A2.5.1.3, A2.5.1.5
Water quality	A2.3.1.3
Presence of pest assessment	A2.2.1.1, A2.2.1.2
Forest growth	A2.4.1.7, A2.2.2.2
Exotic species	A2.2.1.7
Cycles relative to historic patterns	A2.2.1.8, A2.3.1.4, A2.1.1.1
Landscape health and integrity of natural cycles	A2.3.1.4. A2.2.1.8
Land ownership, use, quality and fragmentation	A2.1.1.4

[cont'd]

Appendix 2. Comparison of LSSF indicators and CSA indicators.

LSSF Indicator	Comparable CSA Indicator(s)
Landscape health and integrity of water and soil resources	A2.2.1.4, A2.3.2.1, A2.4.5.1
Land cover assessment/inventory	
Quality of fisheries	A2.3.1.5
Miles of undeveloped shoreline	A2.3.2.1
Wetlands	A2.3.2.1

Appendix 3. CSA indicators that are reflected in one or more LSSF indicators.

CSA Indicator Number	CSA Indicator
A2.1.1.1	Percentage and extent, in area, of forest types relative to historical condition and to total forest area
A2.1.1.2	Percentage and extent of area by forest type and age class (see Clause A2.2.2.1)
A2.1.1.3	Area, percentage, and representativeness of forest types in protected areas
A2.1.1.4	Level of fragmentation and connectedness of forest ecosystem components
A2.1.2.2	Population levels and changes over time of selected species and species guilds
A2.2.1.1	Area and severity of insect attack
A2.2.1.2	Area and severity of disease infestation
A2.2.1.4	Rates of pollutant deposition
A2.2.1.7	Area and severity of occurrence of exotic species detrimental to forest condition
A2.2.1.8	Climate change as measured by temperature sums
A2.2.2.1	Percentage and extent of area by forest type and age class (see Clause A2.1.1.2)
A2.2.2.2	Percentage of area successfully naturally regenerated and artificially regenerated
A2.2.3.2	Frequency of occurrence within selected indicator species (vegetation, birds, mammals, fish)
A2.3.1.2	Area of forest converted to non-forest land use, e.g., urbanization (see Clause A2.4.2.1)
A2.3.1.3	Water quality as measured by water chemistry, turbidity, etc.
A2.3.1.4	Trends and timing of events in stream flows from forest catchments
A2.3.1.5	Changes in distribution and abundance of aquatic fauna
A2.3.2.1	Percentage of forest managed primarily for soil and water protection
A2.3.2.3	Area, percentage, and representativeness of forest types in protected areas (see Clause A2.1.1.3)
A2.4.1.7	Area of forest depletion
A2.4.1.8	Forest wood product life cycles
A2.4.2.1	Area of forest permanently converted to non-forest land use (e.g., urbanization) (see Clause A2.3.1.2)
A2.4.2.2	Semi-permanent or temporary loss or gain of forest ecosystems (e.g., grasslands, agriculture)
A2.4.4.4	Existence of forest inventories
A2.4.5.1	Surface area of water within forested areas
A2.5.1.1	Annual removal of forest products relative to the volume of removals determined to be sustainable
A2.5.1.2	Distribution of, and changes in, the land base available for timber production
A2.5.1.3	Animal population trends for selected species of economic importance
A2.5.1.5	Availability of habitat for selected wildlife species of economic importance
A2.5.3.2	Total employment in all forest-related sectors
A2.5.3.3	Utilization of forests for non-market goods and services, including forest land use for subsistence purposes

[cont'd]

Appendix 3. CSA indicators that are reflected in one or more LSSF indicators.

CSA Indicator Number	CSA Indicator
A2.5.3.4	Economic value of non-market goods and services
A2.5.4.1	Availability and use of recreational opportunities
A2.5.4.4	Area and percentage of protected forest by degree of protection
A2.6.3.1	Number of communities with a significant forestry component in the economic base
A2.6.3.2	Index of the diversity of the local industrial base
A2.6.3.3	Diversity of forest use at the community level
A2.6.3.4	Number of communities with stewardship or co-management responsibilities
A2.6.4.1	Degree of public participation in the design of decision-making processes
A2.6.4.2	Degree of public participation in decision-making processes
A2.6.4.3	Degree of public participation in implementation of decisions and monitoring of progress toward sustainable forest management
A2.6.5.3	Total effective expenditure on public forestry education
A2.6.5.4	Percentage of forest area under completed management plans/programs/guidelines which have included public participation

Appendix 4. CSA indicators that are not reflected in any of the LSSF indicators.

CSA Indicator Number	CSA Indicator
A2.1.2.1	Number of known forest-dependent species classified as extinct, threatened, endangered, rare, or vulnerable relative to total number of known forest-dependent species
A2.1.2.3	Number of known forest-dependent species that occupy only a small portion of their former range
A2.1.3.1	Implementation of an *in situ/ex situ* genetic conservation strategy for commercial and endangered forest vegetation species
A2.2.1.3	Area and severity of fire damage
A2.2.1.5	Ozone concentrations in forested regions
A2.2.1.6	Crown transparency in percentage by class
A2.2.3.1	Mean annual increment by forest type and age class
A2.3.1.1	Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss of organic matter, etc.
A2.3.2.2	Percentage of forest area having road construction and stream crossing guidelines in place
A2.4.1.1	Tree biomass volumes
A2.4.1.2	Vegetation (non-tree) biomass estimates
A2.4.1.3	Percentage of canopy cover
A2.4.1.4	Percentage of biomass volume by general forest type
A2.4.1.5	Soil carbon pools
A2.4.1.6	Soil carbon pool decay rates
A2.4.1.9	Forest sector CO_2 emissions
A2.4.3.1	Fossil fuel emissions
A2.4.3.2	Fossil carbon products emissions
A2.4.3.3	Percentage of forest sector energy usage from renewable sources relative to total sector energy requirement
A2.4.4.1	Recycling rate of forest wood products manufactured and used in Canada
A2.4.4.2	Participation in the climate change conventions
A2.4.4.3	Economic incentives for bioenergy use
A2.4.4.5	Existence of laws and regulations on forest land management
A2.5.1.4	Management and development expenditures
A2.5.2.1	Net profitability
A2.5.2.2	Trends in global market share
A.2.5.2.3	Trends in research and development expenditures in forest products and processing technologies

[cont'd]

Appendix 4. CSA indicators that are not reflected in any of the LSSF indicators.

CSA Indicator Number	CSA Indicator
A2.5.3.1	Contribution to gross domestic product (GDP) of timber and non-timber sectors of the forest economy
A2.5.4.2	Total expenditures by individuals on activities related to non-timber use
A2.5.4.3	Membership and expenditures in forest recreation-oriented organizations and clubs
A2.6.1.1	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights
A2.6.2.1	Extent of Aboriginal participation in forest-based economic opportunities
A2.6.2.2	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural, or spiritual sites
A2.6.2.3	Number of Aboriginal communities with a significant forestry component in the economic base and the diversity of forest use at the community level
A2.6.2.4	Area of forest land available for subsistence purposes
A2.6.2.5	Area of Indian reserve forest lands under integrated management plans
A2.6.5.1	Percentage of area covered by multi-attribute resource inventories
A2.6.5.2	Investments in forest-based research and development and information
A2.6.5.5	Expenditure on international forestry
A2.6.5.6	Mutual learning mechanisms and processes

Appendix 5. CSA indicators that are suitable for the LSSF but were not captured during the two workshops with LSSF stakeholders.

CSA Indicator Number	CSA Indicator
A2.1.2.1	Number of known forest-dependent species classified as extracted, threatened, endangered, rare, or vulnerable relative to total number of known forest-dependent species
A2.1.2.3	Number of known forest-dependent species that occupy only a small portion of their former range
A2.2.1.3	Area and severity of fire damage
A2.2.3.1	Mean annual increment by forest type and age class
A2.3.2.2	Percentage of forest area having road construction and stream crossing guidelines in place
A2.4.1.1	Tree biomass volumes
A2.4.4.5	Existence of laws and regulations on forest land management
A2.5.1.4	Management and development expenditures
A2.5.3.1	Contribution to gross domestic product (GDP) of timber sector of the forest economy
A2.5.4.2	Total expenditures by individuals on activities related to non-timber use
A2.6.1.1	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights
A2.6.2.2	Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural, or spiritual sites
A2.6.5.1	Percentage of area covered by multi-attribute resource inventories
A2.6.5.6	Mutual learning mechanisms and processes

This report was completed as part of the requirements for a project funded by the Great Lakes Environmental Protection Fund. The objective of the project was to develop a new forest management planning system for the Lake Superior State Forest that meets sustainable forest management standards, specifically those of the Canadian Standards Association and the Forest Stewardship Council.

Project Partners:

Michigan Department of Natural Resources
Mater Engineering, Ltd.
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Anne Hayes
Brian Callaghan (Callaghan & Associates Inc.)
Tom Clark (CMC Consulting)

Reports generated by this project include:

Project Summary: The Lake Superior State Forest Sustainable Forest Management Pilot Project

An Assessment of the Michigan Department of Natural Resources' Commitment to Sustainable Forest Management

The Lake Superior State Forest: A Description

Michigan Department of Natural Resources Operations Inventory: Survey Results

Roles and Responsibilities for Forest Management Planning in the Lake Superior State Forest

Public Participation in Forest Management Planning in the Lake Superior State Forest: Finding the Right Pathway

Establishing Criteria and Indicators for the Lake Superior State Forest

Workshop I Summary: Values and Indicators of the Lake Superior State Forest

Workshop II Summary: Establishing Targets, Practices and Responsibilities for the Indicators of the Lake Superior State Forest

Modeling Forest Management on the Lake Superior State Forest

Wildlife Habitat Projections for 15 Species in the Lake Superior State Forest

Risk Assessment of Forest Management for the Lake Superior State Forest

A Forest Management Planning Guide for the Lake Superior State Forest

Further information on this report or any of the reports listed may be obtained from:

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